UNIVERSITY OF NORTH BENGAL
B.Sc. Honours 1st Semester Examination, 2021

CC2-CHEMISTRY

PHYSICAL CHEMISTRY

Time Allotted: 2 Hours   Full Marks: 40

The figures in the margin indicate full marks.
All symbols are of usual significance.

Answer any *four* questions   10×4 = 40

1. (a) Define mean free path and collision diameter.   2

   (b) Viscosity of a gas rises with temperature whereas that of liquid decreases. Explain.   3

   (c) Explain the exceptional behavior of hydrogen and helium.   2

   (d) Calculate the critical constants, a and b if $T_c = 31°C$, $P_c = 72.8$ atm, $R = 0.0821$ litre atm degree^{-1}mole^{-1}.   3

2. (a) Derive the Henderson equation for determination of pH of a buffer solution.   3

   (b) Calculate pH of a 0.2M solution of NH_4Cl.   3

   Given $K_w = 1.008 \times 10^{-14}$, $K_b = 1.8 \times 10^{-5}$.

   (c) The viscosity of diethyl ether is 2.33 mP at 20°C and 1.97 mP at 40°C. Calculate the activation energy of diethyl ether for viscous flow.   4

3. (a) Describe Braggs' law for crystal structure determination. Also find the deviation of direction of diffracted X-ray beam with respect to the direction of incident X-ray beam if Braggs' diffraction occurs.   3+3

   (b) Five-fold symmetry can't be explained by Braggs' diffraction. — Explain.   4

4. (a) Show that C_P/C_V for a monoatomic gas is 1.66.   3

   (b) At N.T.P. the viscosity co-efficient of oxygen is 0.2 mP. Find the collision diameter of oxygen molecule.   3

   (c) Find the relationship between K_a and K_b for an acid and its conjugate base.   4

5. (a) The solubility products of ferric hydroxide is 1.1×10^{-36} at 25°C. Calculate the solubility of ferric hydroxide in g/litre [Fe = 56, O = 16].   3

   (b) What is common ion effect?   2

(c) Calculate the pH of 10^{-8} M HCl solution. 3

(d) Find out the ionic product of water. 2

6. Write short notes on the following: 10
   (a) Surface active materials
   (b) Law of rationality of indices
   (c) Buffer solution
   (d) Acid-base indicators.

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